



**COCONINO**  
COUNTY ARIZONA

**FLOOD CONTROL DISTRICT**



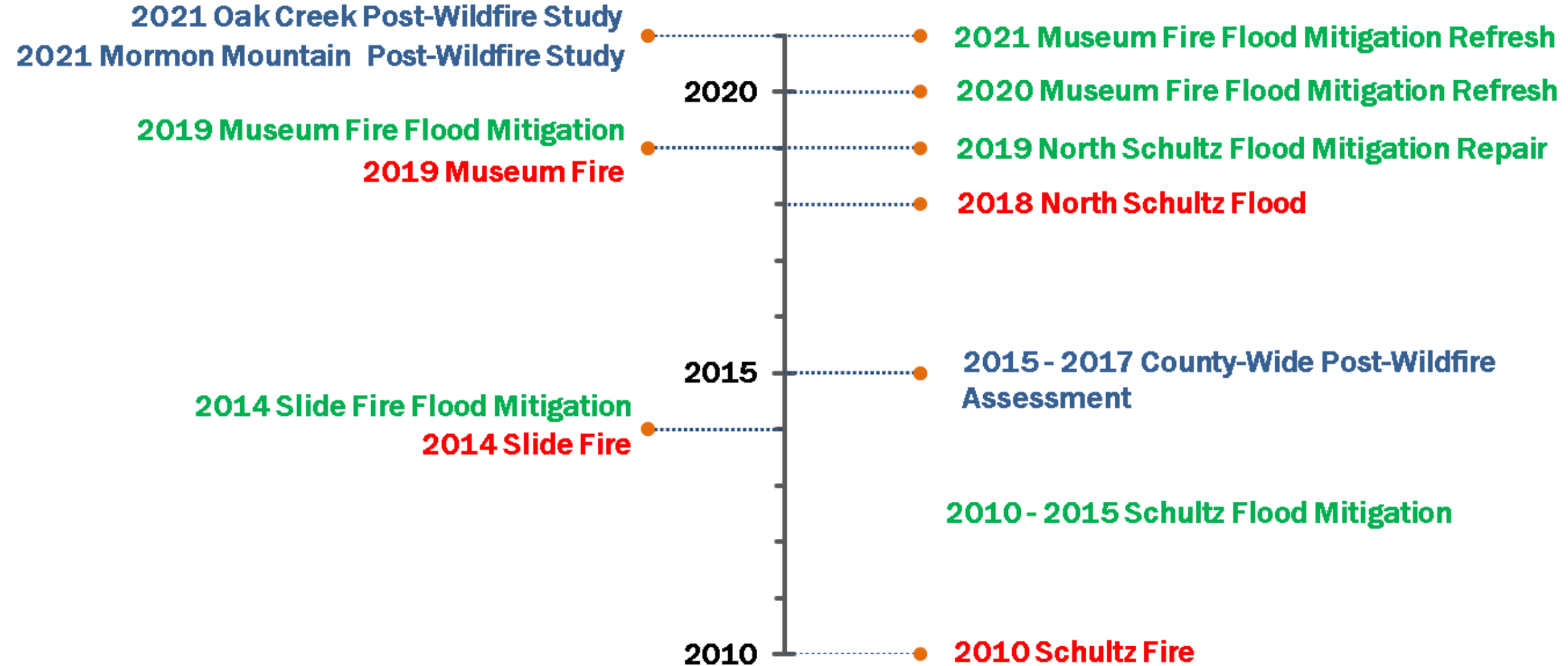
Museum Flood Area

***Museum Post-Wildfire  
Flood Threat Analysis &  
Mitigation Preparation***

***April 13, 2021***



# ***Timeline of Events, Mitigation and Studies***



# ***2010 Post-Schultz Fire Flooding***

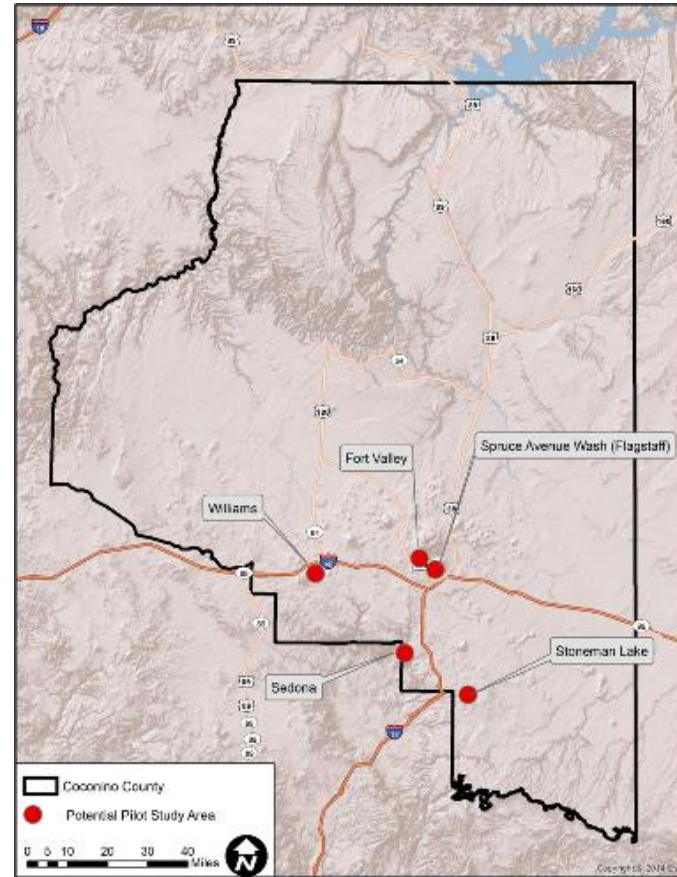




# **2015 FEMA Cooperating Technical Partner Grant Assessment of Post-Wildfire Flood and Debris-flow Hazards in Coconino County**

## **Study Purpose**

- 1. Determine potential post-wildfire flood and debris-flow risk within Coconino County**
- 2. Determine severity of risk**
- 3. Detailed analysis in two areas**



**Fort Valley and Williams Areas selected for detailed modeling**

- Fire modeling**
- Potential post-fire debris flow and flood**
- Spruce Avenue Watershed identified as at high risk**
- FWPP Dry Lakes Project Studied & Underway**



# ***2019 Museum Fire Flood Risk Assessment***

***Joe Loverich, P.E., C.F.M***





# Museum Fire

- Burned 1,961 acres
- 52% of Spruce Avenue Wash watershed burned
- Of the total area burned, 53% burned severely and moderately
- Potential flooding could affect over 400 homes and 50 businesses





# ***Museum Fire Soil Burn Severity***

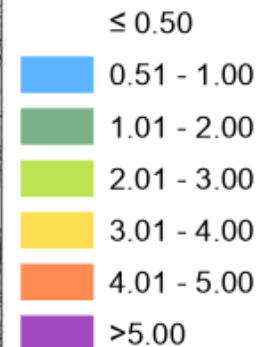




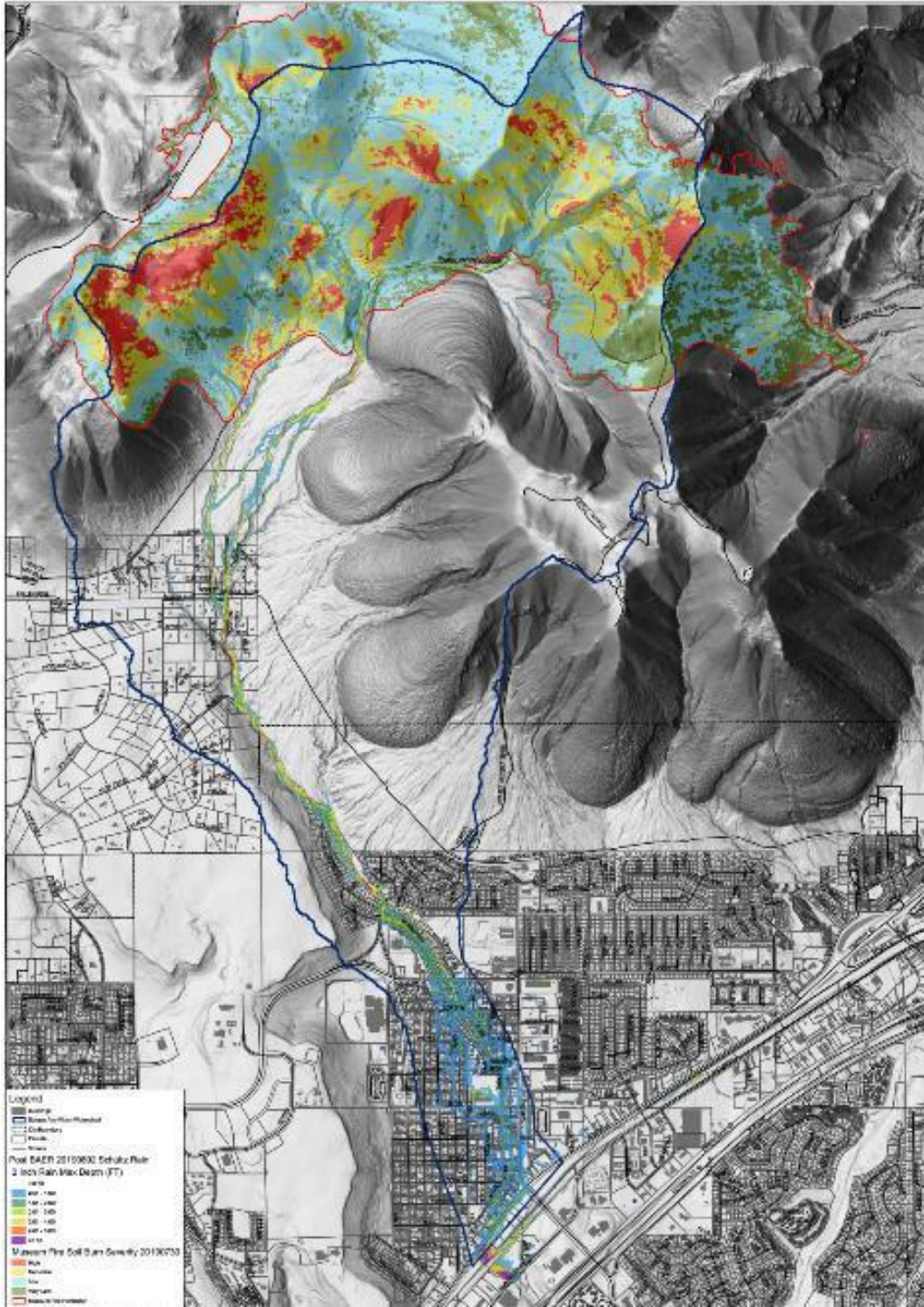
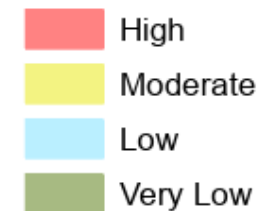
# Post-Wildfire Flood Risk Modeling

- 2-Dimensional Pre-and Post-Fire Flood Modeling
- 1 hour Storm based on actual events in the Schultz Watershed
- Rainfall Depths of 1" to 3" modeled
- Peak flow increase of 10 times For the 2" rainfall

2 Inch Rain Max Depth (FT)



Museum Fire Soil Burn Severity





# ***Post-Wildfire Flood Risk Modeling***

2 Inch Rain Max Depth (FT)

≤ 0.50

0.51 - 1.00

1.01 - 2.00

2.01 - 3.00

3.01 - 4.00

4.01 - 5.00

>5.00







# ***2021 Museum Flood Risk Modeling Validation***

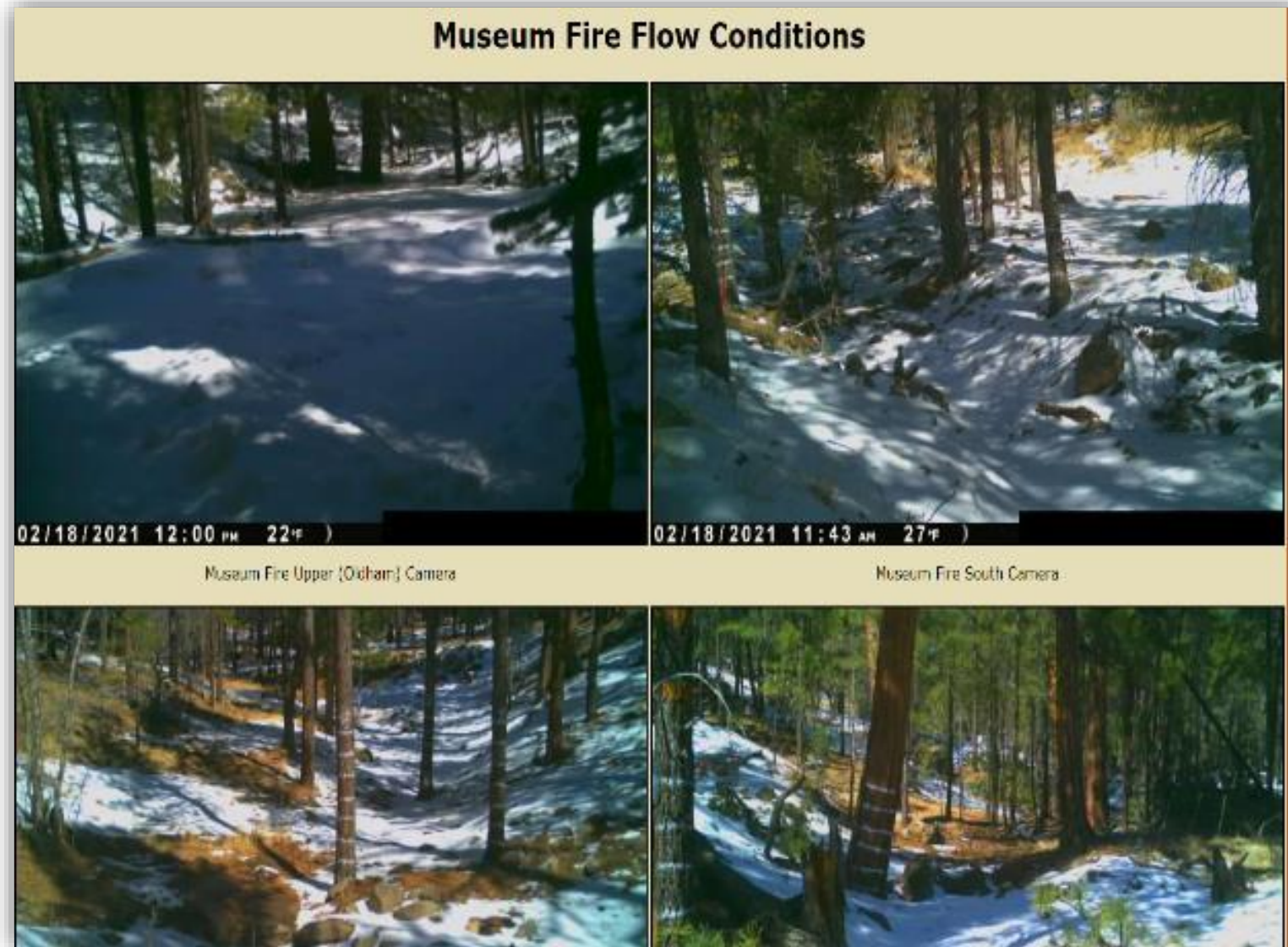
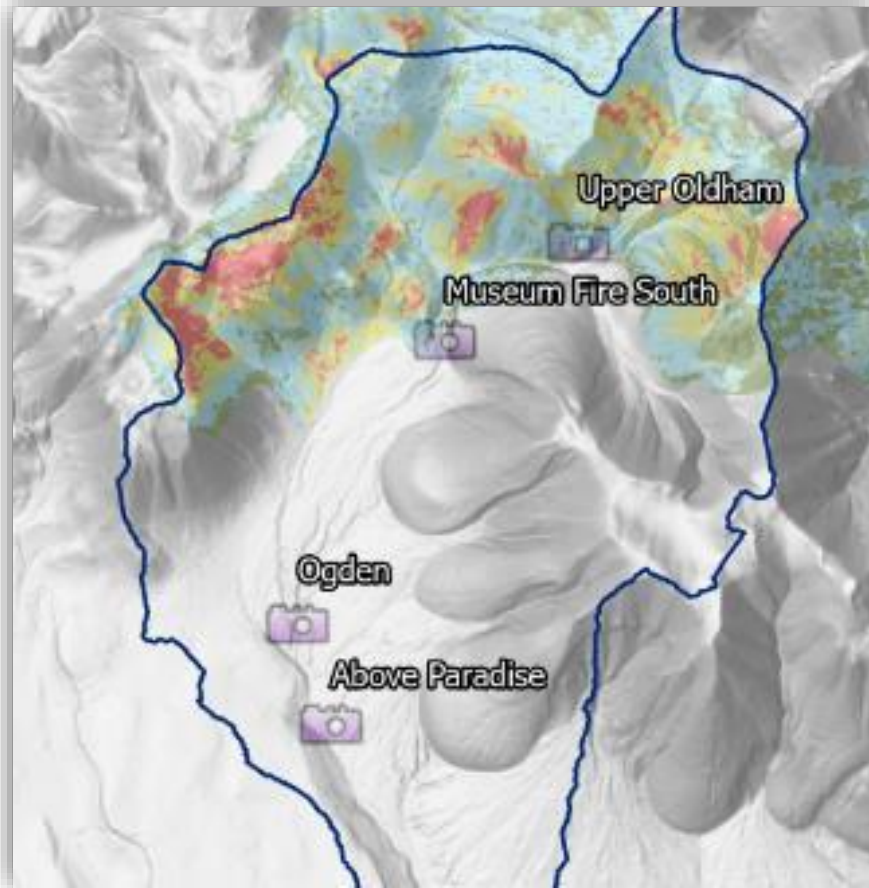


Museum Flood Area



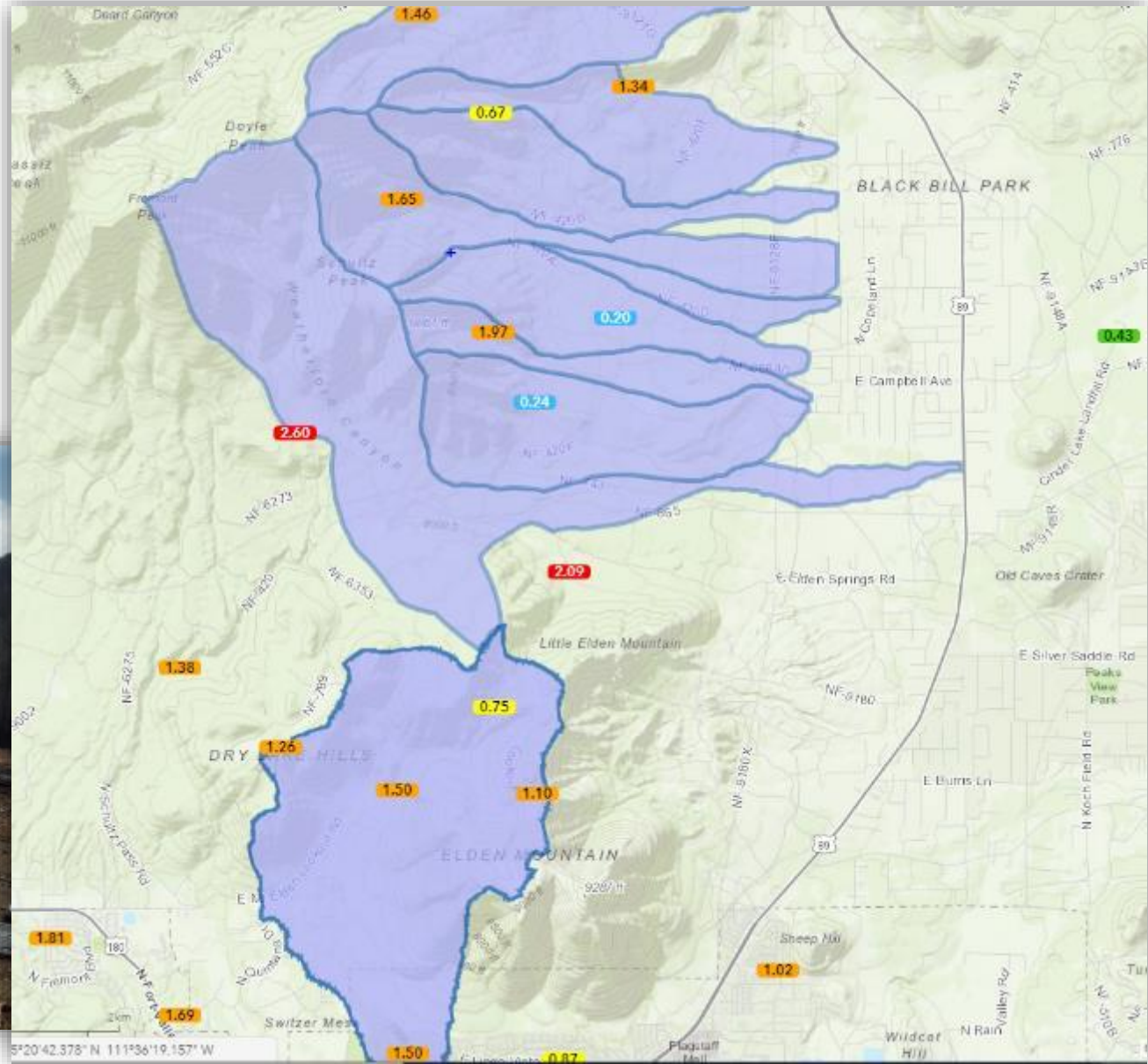
# Realtime Precipitation and Flow Monitoring

- <https://rain.flagstaffaz.gov/jefmap/>
- <https://coconino.jefulleralert.com/jefmap/>
- <https://coconino.jefulleralert.com/MuseumFireCameras/>





# Rainfall Stations within Schultz and Museum Fire Watersheds

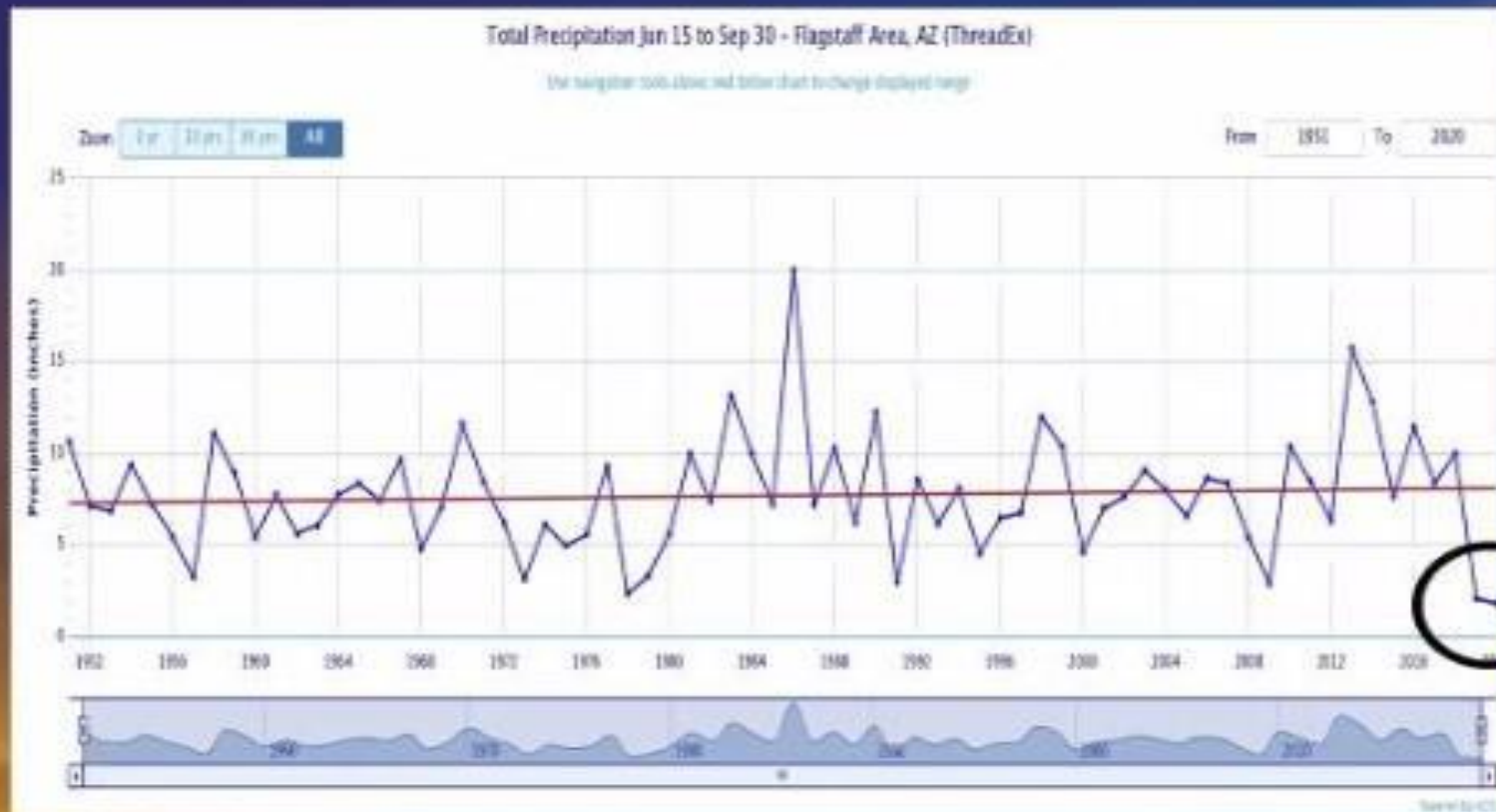




# Monsoon History



## Flagstaff Monsoon Rainfall Since 1951 (Airport Observations)



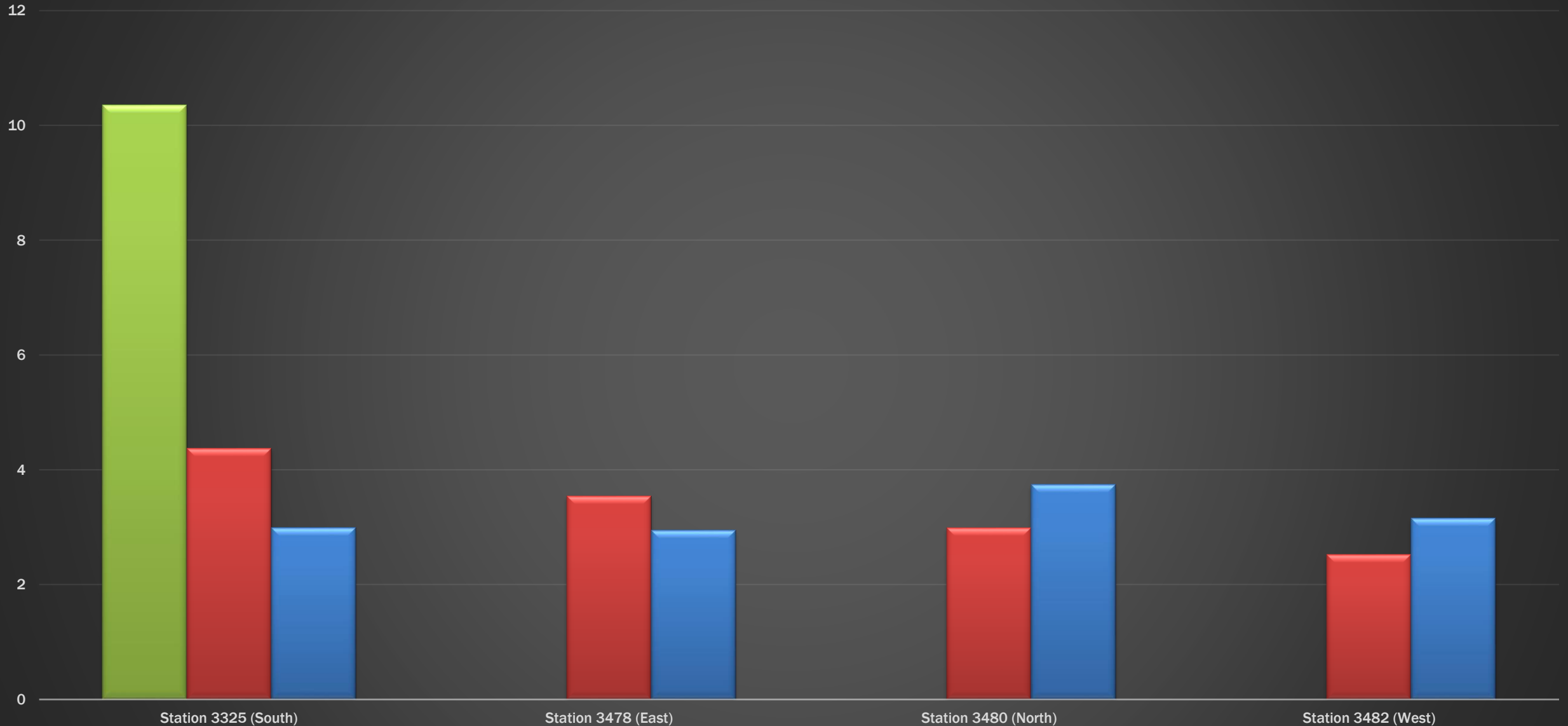
- Even with the two dry Monsoons in 2019 and 2020, the trend is still for *wetter* conditions.
- Highly unlikely we'll see another dry monsoon like the previous years.

2 'Nonsoon' Years



# 2018 through 2020 Rainfall Totals

July-September Precipitation Totals Comparison (Inches)



*The East, North, and West rain stations were installed in the Museum Fire burn scar in late July 2019*

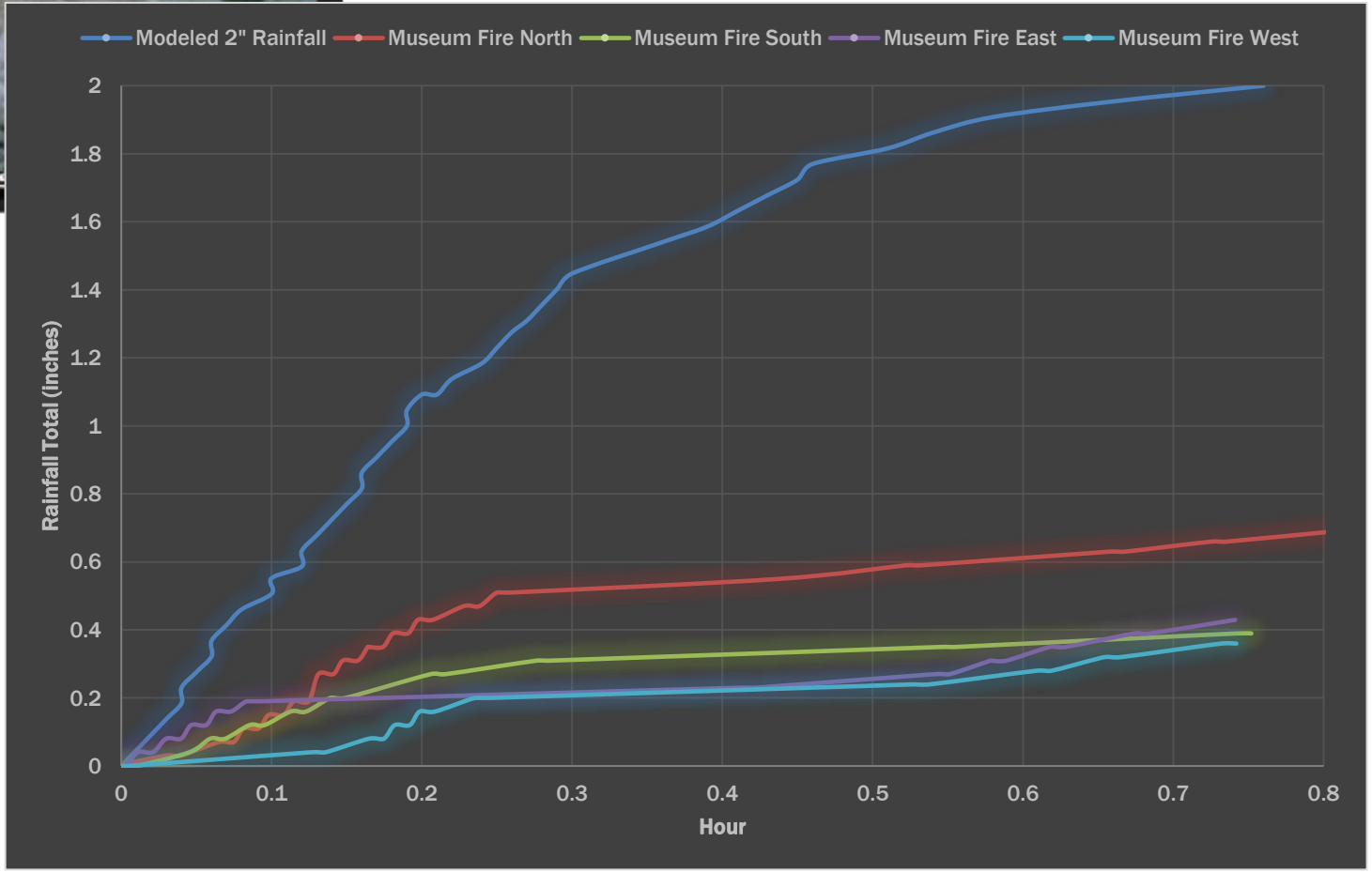
■ Summer 2018 ■ Summer 2019 ■ Summer 2020

Upper Oldham Fire Camera has first flow between 14:55 and 15:00



# July 24, 2020 Rainfall & 2" Model Validation

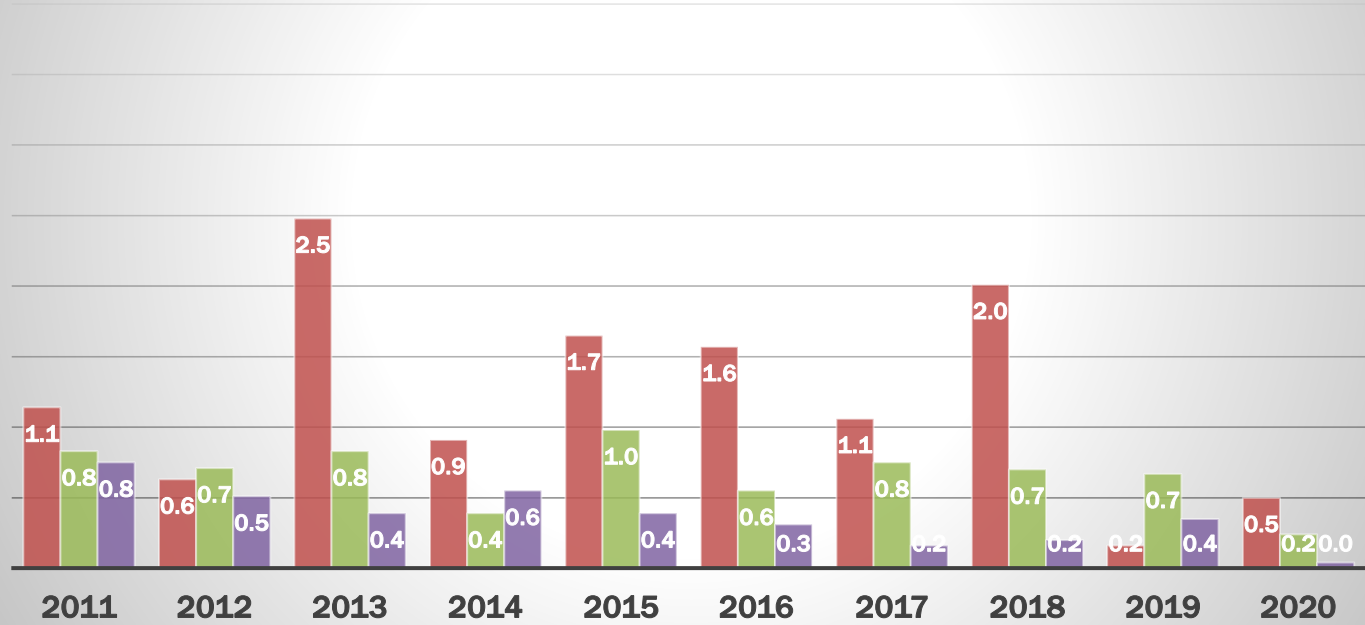
Threshold of Rain Totals in 15 Minutes (INCHES)	Time of 1 <sup>st</sup> Notification
0.10	14:42
0.25	14:50
0.40	14:57





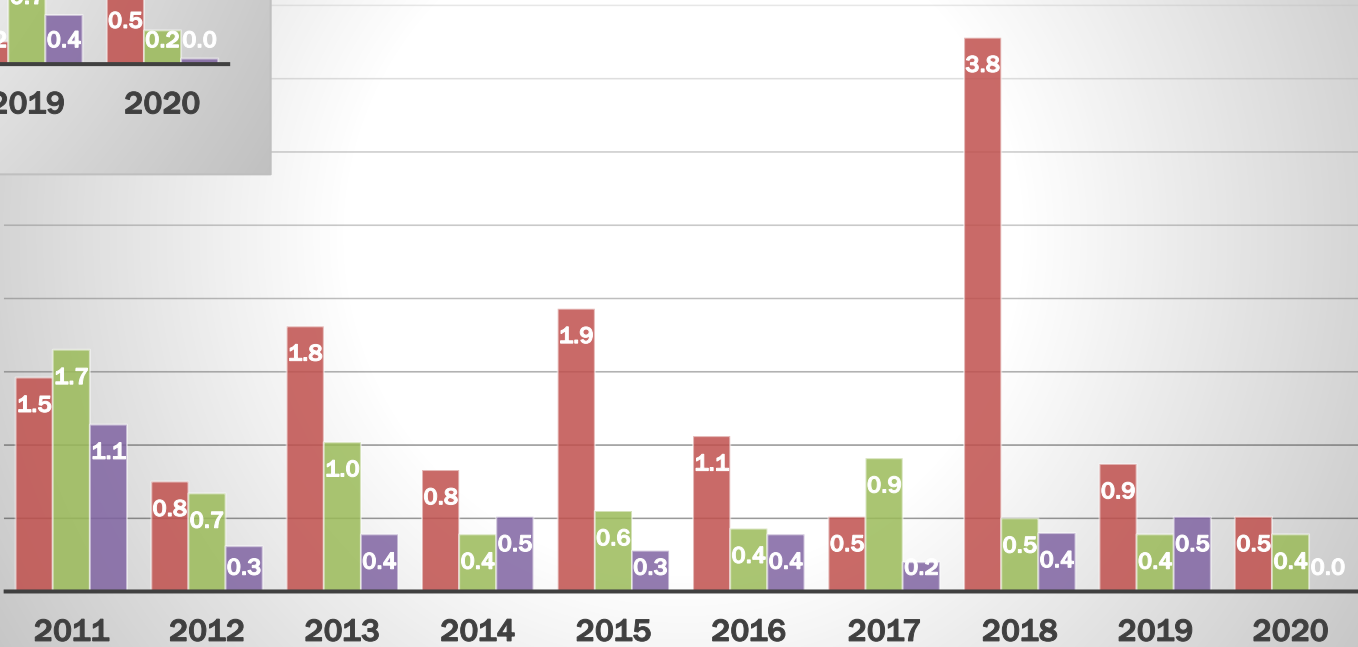
- July
- August
- September

Maximum Hourly Rainfall Totals in Inches  
Station 3470: Paintbrush



# Rainfall Examples from Schultz

Maximum Hourly Rainfall Totals in Inches  
Station 3462: Upper Campbell-Copeland



Maximum Hourly Rainfall Totals by Month Station 3480: Museum Fire North (inch)			
Year	July	August	September
2019	0.1	0.5	0.4
2020	0.8	0.2	0.0

Maximum Hourly Rainfall Totals by Month Station 3478: Museum Fire East (inch)			
Year	July	August	September
2019	0.1	0.9	0.4
2020	0.5	0.2	0.0





***Current Condition  
Of The  
Museum Fire Burn Scar***



Museum Flood Area



# **Watershed Conditions**

## **February 2020 and November 2020**





# Watershed Conditions November 2020







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***Questions & Comments?***



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# ***Consensus Regarding Flood Threat***

- Monsoon seasons following the fire have been the lowest in recorded history
- The few rain events on the burn scar have shown the watershed can easily produce debris flows and ten-fold increase in runoff (130 CFS to 1,300 CFS)
- The watershed has experienced little recovery in moderate and high burn severity areas
- Model Validation has confirmed threat.....
- National Weather Service...expect return to normal monsoon this year







# ***Consensus Regarding Flood Mitigation Measures***

- The combined City/County/Hydrology team unanimously agree the residential areas downstream of the Museum Fire burn scar are still at high risk of post-wildfire flooding
- Flood mitigation measures within the residential areas should remain in place
- A 2021 pre-monsoon maintenance effort is being planned to replace degraded sandbags and ensure drainages are free of debris
- A major communications effort is being planned to communicate with residents & property owners about the need to continue mitigation
- Joint meeting with City Council & County – April 26



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***2019 Immediate Post-Fire  
Flood Mitigation Campaign***







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# 2019 Flood Mitigation Campaign

- County Flood Control District, at the request of the City of Flagstaff, led the campaign to develop and then worked with the city to deploy flood mitigation measures within the flood hazard area
- Mitigated ~400 homes & ~35 businesses in ~2 weeks; County Cost = \$1.2M
- Flood mitigation includes sandbags and concrete barriers



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# ***2019 Flood Mitigation Campaign***

- Maintenance was also conducted to remove trees & debris from drainage channels
- Many public meetings held; larger meetings at Coconino High & smaller meetings within the impacted neighborhoods to inform residents of mitigation strategies, to educate regarding flood warning protocols and recommended action (shelter in place)







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# ***2020 Museum Flood Mitigation Refresh***

- County & City placed sand bags into the Sunnyside Neighborhood
- All concrete and water barriers were checked & refilled
- Worked with Conservation Crews and United Way to restore mitigation for elderly and disabled





Museum Flood Area

# ***2020 Museum Flood Mitigation Refresh***

- United Way of Northern Arizona Established Call Center while County Call Center Managed COVID-19 Response
- American Conservation Experience
  - 32 elderly and disabled residence in Museum Flood Area were supported
  - 700 Sandbags placed by ACE Crews
  - Drainages Cleared of debris by ACE Crews
- 5,000 sandbags on pallets stage through out Museum flood area for resident convenience



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# ***2021 Museum Flood Mitigation Shore-Up***



Museum Flood Area



Museum Flood Area

# **2021 Shore-up of Flood Mitigation Measures**



- Evaluation of all current measures
- Communications to citizens on where to get pre-made sandbags:
  - Neighborhoods
  - King Street Self-fill Station– County
  - Joe Montalvo Park– City of Flagstaff
- Call to Public for elderly and disabled who need help with sandbags to contact United Way







Museum Flood Area

# 2021 Shore-up of Flood Mitigation Measures



- Call Center to take request for service
- FCD will manage and prioritize all requests
  - County Engineering will update all cooperator agreements before working on private property
    - Process managed with Salesforce Software
- Arizona Conservation Corps will remove and replace broken sandbags, starting May 24<sup>th</sup>
- Road Maintenance crews will transport sandbags from Sheep Hill to Museum Flood Area
- All Shore-up work to be completed by July 1<sup>st</sup>, 2021





# ***Preliminary Communications Plan Highlights***



Museum Flood Area

***Alex Fischer & Marc Della Rocca***





Museum Flood Area

# ***KEY MESSAGES | Spanish & English***

- It is critical to remember that the threat of flooding is real and that properties will remain at high risk for post-wildfire flooding for several years.
- The County's flood mitigation consultant, JE Fuller recently validated the flood model for the Museum Flood area showing that a serious flood threat still remains.
- The FCD and City strongly recommend keeping your flood mitigation in place through the 2021 monsoon season.
- There has been little natural recovery on the moderately and severely burned areas in the Museum burn area.
- Although we are fortunate to have not yet experienced any flooding, it is important to note that the last two monsoon seasons have been classified by the National Weather Service (NWS) as the driest on record.



# ***KEY MESSAGES | Spanish & English***

- A normal monsoon season is predicted by the NWS in 2021.
- Because of the nature of water, flood mitigation should be contiguous – not piecemeal - with no gaps. The mitigation installed in the Museum Flood Area was mostly designed to convey floodwaters downstream and out of the neighborhoods.
- Removal of any section of this mitigation from an individual property may compromise the effectiveness of this system and could result in adverse flooding impacts on adjacent properties, for which the private property owner who removed the mitigation could be held responsible for any damage.
- Sign up for Emergency Notifications.
- Get Flood Insurance.







# **KEY CHANNELS + AUDIENCE**

## ***Spanish & English***

### Social Media

- Social Media – Flagstaff
- Social Media – Coconino County
- Facebook Live – In the Coconi-*Know*

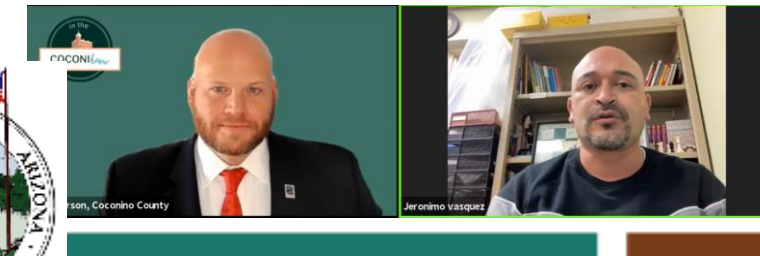


### Digital

- Coconino External Newsletter
- Coconino Internal Newsletter – The Connect
- City of Flagstaff Digital Channels



Museum Flood Area





Museum Flood Area

# KEY CHANNELS + AUDIENCE

## Spanish & English

### Print

- 2021 Museum Flood Guide
- 2021 Museum Flood Advisory
- Sandbag Refresh Event Flier
- FCD Update Letter

#### Guía de Preparación y Mitigación de Inundaciones para "Museum Flood Area"

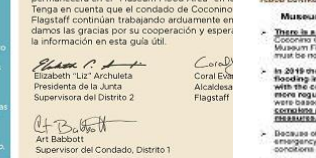
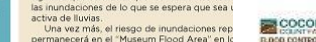
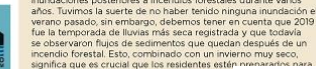
Línea directa de "Museum Flood Area": (928) 679-8525  
Correo electrónico: [museumfloodinfo@coconino.gov](mailto:museumfloodinfo@coconino.gov)  
Página web de "Museum Flood Area": [www.coconino.gov/museumfloodarea](http://www.coconino.gov/museumfloodarea)

#### Emergency Notifications

Regístrese para recibir Notificaciones de Emergencia!  
El servicio gratuito de Notificación de Emergencia del Condado de Coconino proporciona alertas para emergencias como incendios forestales, tormentas eléctricas, tornados e inundaciones repentinas en su área. Regístrese por celular, correo electrónico y/o su teléfono de casa. Visite [www.coconino.gov/ready](http://www.coconino.gov/ready) para suscribirse a las Notificaciones de Emergencia o comuníquese con el Departamento de Emergencias del Condado de Coconino al 928-679-8311.

#### EL RIESGO ES REAL. Compre o renueve su seguro de inundaciones ahora.

El Condado recomienda a todos los dueños de propiedades en el "Museum Flood Area" que compren y mantengan un seguro contra inundaciones. El seguro contra inundaciones debe mantenerse incluso en aquellas áreas donde se han controlado medidas de mitigación de inundaciones. El seguro contra inundaciones sigue siendo la única forma de abordar los impactos de inundaciones en los hogares. Para obtener información sobre el Programa Nacional de Seguro contra Inundación (NFIP) por sus siglas en inglés, llame al Centro de Ayuda del NFIP al 800-427-4661 o envíe el número 1 a para recibirlo o visite <https://www.floodsmart.gov/es/ncid>.



#### Flood Preparedness and Mitigation Guide

Museum Flood Area Edition (XERO 879-8525)  
Museum Flood Area Email: [museumfloodinfo@coconino.gov](mailto:museumfloodinfo@coconino.gov)  
Museum Flood Area Website: [www.coconino.gov/museumfloodarea](http://www.coconino.gov/museumfloodarea)

#### Emergency Notifications

COCONINO COUNTY'S flood management and mitigation services are available to help you prepare for emergencies such as wildfires, threatening conditions and flood flooding in your area. Sign up your cell phone number, email and/or your home address.

Go to [www.coconino.gov/ready](http://www.coconino.gov/ready) to register for emergency notifications. You can also call the Coconino County Emergency Department at 928-679-8311.

#### THE RISK IS REAL. PURCHASE or RENEW your flood insurance now.

Go to [www.floodsmart.gov](http://www.floodsmart.gov) to learn more about flood insurance and how to purchase it. Flood insurance is the only way to protect your property and belongings from the financial impact of flooding. Flood insurance is not required by law, but it is highly recommended. Flood insurance can help you recover from the financial impact of flooding. Flood insurance can help you recover from the financial impact of flooding. Flood insurance can help you recover from the financial impact of flooding.



#### Museum Flood Area Sandbag Sites



Dirt to 2625 I Count Service



Visit [fema.gov](http://fema.gov) for additional sandbag information.





# ***KEY CHANNELS + AUDIENCE***

## ***Spanish & English***

### **Traditional Media**

- Radio (KAFF)
- Joint Press Releases with City
- Pitch/Interview with AZ Daily Sun

### **Outreach**

- Meetings in the Street
- Neighborhood Groups
- Public Virtual Meetings with City





## ***Questions & Comments?***



Museum Flood Area





# ***Long-Term Mitigation Efforts***



Museum Flood Area



Museum Flood Area

# ***COF Post-Fire Mitigation Projects***

- **Utility and channel protections – 7 cross vein rock weirs**
  - \$112,000 from Water Services, delivered by Community Development
- **Debris bollards at Linda Vista and Dortha Inlets**
- **Linda Vista Culvert upsizing**
  - \$283,090 from Stormwater contingency & CIP, delivered by Community Development
- **Cedar Avenue culvert dredging, and channel configuration**
  - ~\$12,000 from Stormwater open channel maintenance, delivered by Stormwater and Public Works
- **Annual channel and stormwater conveyance cleaning**
  - ~\$9,000/yr last two years, Stormwater open channel maintenance funds
  - Two weeks of Water Services Collections crews vac-trucking Sunnyside catch basins
- **New flood ALERT gauge at Spruce Wash and Route 66**
  - ~\$10,000 paid for by State Emergency Council and Stormwater planning funds







Museum Flood Area

# ***COF Ongoing and Planned Mitigation***

- **Dortha inlet dredging and re-configuration (also engineered solution to re-open Dortha Street)**
  - In design phase, design cost: \$57,770
  - Stormwater reserve funds for design, construction will use CIP funds through deferment of other projects
- **Killip School regional flood detention basin**
  - In design phase, cost split between FUSD and Stormwater
  - Construction cost will be Stormwater CIP and/or Stormwater contingency funds
- **FUTS low water crossing armoring and risk mitigation – Spruce Wash at Route 66**
  - \$24,000 anticipated cost, FEMA PDM grant and Stormwater CIP and maintenance funding
- **Lower Spruce Wash channel resiliency and utility crossing armoring**
  - In design, \$38,222 for design paid for by Stormwater CIP
  - Construction costs split between FEMA HMGP grant and Stormwater CIP
- **Purchase of EV mini-dozer for Cedar Avenue box culvert cleaning (as well as other maintenance)**
  - Presenting to Council April 20th for consent, if approved will be funded by Stormwater maintenance
- **Upgrade of existing flood ALERT gauge at Mount Elden Road (downward looking radar)**
  - \$6500 from Stormwater
- **Continued coordination with CC FCD for Flood Director duties and on-going watershed monitoring**
  - Staff time from multiple COF divisions and



# **Cross-Vein Weirs & Spruce Wash Channel Dredging**

Seven cross-vein weirs with 4-foot keystone members to protect existing water main and natural gas pipeline

Summer 2020 Spruce Wash channel dredging and re-configuration at Cedar Avenue





# ***Linda Vista Culvert Upsizing & New Debris Pollards***

Linda Vista culvert upsizing –  
Summer 2020

New Debris Pollards at  
Linda Vista and at Dortha





# ***Flood Control District Long-Term Mitigation Efforts***

- Completed an on-forest channel/alluvial fan stabilization project in the spring of 2020 (\$225,000)
- Cleaned out an earthen basin within the Mount Elden Estates neighborhood to restore limited sediment storage capacity (\$15,000)
- A flood mitigation project within Mount Elden Estate will be constructed this spring (\$550,000)
- Evaluating further opportunities for alluvial fan stabilization between Lockett Ranches and Paradise Drive
- Will be working with the City and USFS to evaluate a project at the top of Paradise Drive to widen the channel (there basically isn't any channel in this location)





Museum Flood Area

# ***Flood Control District Long-Term Mitigation Efforts***



**On-Forest Alluvial Fan Stabilization**



**Basin and Channel Clearing  
Mt. Elden Estates**





## ***Questions & Comments?***



Museum Flood Area